Prospects of the gluon polarization measurement at PHENIX

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The Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) started operation as a polarized proton collider in the 2001--2002 run. All devices for the transversely polarized proton collisions were successfully commissioned at $\sqrt{s} = 200$ GeV. PHENIX recorded 4 times 10^9 events to measure transverse-spin asymmetries in several channels.

In the upcoming 2002--2003 run, spin rotator magnets which manipulate the polarization direction of the proton at the collision point will be taken into operation allowing for proton collisions with longitudinal polarization. We will measure double longitudinal-spin asymmetries to obtain the gluon polarization in the proton. The expected integrated luminosity for this run is more than 3 pb^{-1} and the polarization more than 40 \%. The asymmetry measurement of jet production provides information on the gluon polarization through quark--gluon and gluon—gluon reactions. The asymmetry of pion production will be measured at PHENIX as an alternative to the jet measurement.

In the 2001--2002 run, we have studied systematic errors related to spin-sorted luminosity and polarization measurement, and detector performance. Prospects of the gluon polarization measurement in the 2002--2003 run will be discussed. By using higher luminosity and polarization in the future, we will obtain largely increased sensitivity to the gluon polarization with heavy flavor production and prompt photon production. Future plans including detector upgrades of PHENIX will be discussed.